THE ASTRONOMICAL JOURNAL

FOUNDED BY B. A. GOULD

PUBLISHED FOR THE AMERICAN ASTRONOMICAL SOCIETY
BY THE AMERICAN INSTITUTE OF PHYSICS INC.

Editors

L. WOLTJER

N. H. BAKER

Assistant Editors

BARBARA DEGRAFF

MARRET MCCORKLE

Associate Editors

HAROLD F. WEAVER
Leuschner Observatory

FRED L. WHIPPLE
Smithsonian Astrophysical Observatory

S. CHANDRASEKHAR
University of Chicago

HELMUT A. ABT
Kitt Peak National Observatory

VOLUME 73

1968

NUMBERS 1356–1365

Editorial Office: Department of Astronomy, Columbia University, New York, N. Y. 10027

Publications Office: American Institute of Physics, Inc., New York, New York 10017

Printed at: Lancaster Press, Inc., Lancaster, Pennsylvania

CONTENTS

NUMBER 1356

Upper Limits to the Degree of Circular Polarization of the Integrated 1418-MHz Radiation from Radio Galaxies by G. A. Seielstad and K. W. Weiler 1
Effect of Rotation on the Colors and Magnitudes of Stars in Praesepe by R. J. Dickens, Robert P. Kraft, and W. Krzeminski 6
Photoelectric *K*-Line Spectral Classification by G. W. Lockwood 14
The Cluster of Early-Type Stars, Stock 13 by J. A. Graham 17
Wavelength Dependence of Polarization. XI. Mu Cephei by G. V. Coyne and A. Kruszewski 20
Orbital Elements of RR Centauri by Beverly B. Bookmyer 26
Photoelectric Observations of SZ Lyncis by L. Binnendijk 29
The Light Variation and Orbital Elements of OO Aquilae by L. Binnendijk 32
Approximating Functions for Eclipsing Binary Solutions by H. F. Fliegel and Robert E. Wilson 42
Proper Motions for M Stars in the Region of the Pleiades by W. F. van Altena 44
Parallaxes of 21 Stars Determined from Plates Taken with the McCormick 26-in. Refractor by Phillip K. Lu and Laurence W. Fredrick 47
Observations of Bright Minor Planets and Comets by Betty F. Mintz 49
A Porosity-Polarization Relationship Applicable to the Lunar Surface by Walter G. Egan and Edward A. Nowatzki 57
Erratum: Systematic Errors of Meridian Instruments. (*Astron. J.* **72**, 552, 1967) by Robert d'E. Atkinson 60
Erratum: On Particle-Tracks near a Massive Star (*Astron. J.* **72**, 915, 1967) by Robert d'E. Atkinson 60
Addendum: A Possible Extended Atmosphere in the Eclipsing System VV UMa (*Astron. J.* **70**, 368, 1965) by Robert E. Wilson 60
Editorial Notice 60

NUMBER 1357

Galactic Radio Emission at 610.5 MHz. I. The Region between Galactic Longitudes 47° and 56° by H. Wendker and K. S. Yang 61
Supernovae and Supernova Remnants by A. Poveda and L. Woltjer 65
Relative and Absolute Photometry of 185 Stars by John S. Neff 75
UBV and Narrow-Band *uvby* Photometry of Bright Stars by Michel Breger 84
Characteristics of Invariant Curves of Plane Orbits by George Contopoulos and John D. Hadjidemetriou 86
Orbit of Comet 1961 V (Wilson-Hubbard) by Richard L. Branham, Jr. 97
Long-Period Effects in the Motion of Hilda-Type Planets by Joachim Schubart 99
A Classification of Orbits through L_1 in the Restricted Three-Body Problem by John D. Hadjidemetriou 104
On a Family of Periodic Orbits of the Restricted Three-Body Problem and the Question of the Gaps in the Asteroid Belt and in Saturn's Rings by G. Colombo, F. A. Franklin, and C. M. Munford 111

NUMBER 1357

Supplement

ABSTRACTS of Papers Presented at the 125th Meeting of the American Astronomical Society, held 4–7 December 1967 at the University of Pennsylvania, Philadelphia, Pennsylvania S1

Further Reports of Observatories

David Dunlap S43
Goethe Link S48

NOTICE S51

NUMBER 1358

Articles

Variations in the Radar Cross Section of Venus by J. V. Evans 125
Survey of Radio Sources Observed in the Continuum near 1420 MHz, Declinations −5° to +70° by J. A. Galt and J. E. D. Kennedy 135
Spectra and Colors of A-Type Stars in a North Galactic Pole Region by Arne Slettebak, Robert R. Wright, and J. A. Graham 152
Photometry of the Eclipsing System BR Cygni by Peter A. Wehinger 159
Photometric Studies of the Eclipsing Systems BV 412, BV 332, and V 836 Cygni by Allen Joel Harris 164
Photoelectric Photometry of Selected AG Stars in the 25° to 30° Zone by Gustav A. Bakos 187
Dynamical Evolution of Triple Stars by Robert S. Harrington 190

The Use of Electronic Computers for Analytical Developments in Celestial Mechanics: A Colloquium held by Commission 7 of the IAU in Prague, 28–29 August 1967

Computers in Celestial Mechanics by W. J. Eckert 195
Programming Systems for Analytical Developments on Computers by M. S. Davis 195
Review of Some Methods of Programming of Literal Developments in Celestial Mechanics by J. Kovalevsky 203
Lindstedt's Series on a Computer by Andre Deprit and Arnold Rom 210
Applications of Literal Series to the Main Problem of the Lunar Theory by Jean Chapront and Liliane Mangeney-Ghertzman 214
FORMAC Language and its Application to Celestial Mechanics by A. R. LeSchack and P. Sconzo 217

NUMBER 1359

Articles

Comparison of the Effects of Microturbulence and Metal Abundance on the Strömgren Photometric Indices of Main Sequence *F*-Type Stars by Robert P. Kraft, L. V. Kuhi, and P. S. Kuhi 221
Blue Horizontal Branch Stars in NGC 6397 by J. A. Graham and Catharine Doremus 226
Stars in Reflection Nebulae by René Racine 233
A Finding List of Proven or Probable Small Magellanic Cloud Members by N. Sanduleak 246
Multicolor Photoelectric Photometry of the Brighter Planets. II. Observations from Le Houga Observatory by William M. Irvine, Theodore Simon, Donald H. Menzel, Jacques Charon, G. Lecomte, Paul Griboval, and Andrew T. Young 251
Structured Events in the Dynamic Spectra of Jupiter's Decametric Radio Emission by Jorma J. Riihimaa 265
Venus: On an Inverse Variation with Phase in the 3.4-mm Emission during 1965 through 1967 by Eugene E. Epstein, John P. Oliver, Steven L. Soter, Ronald A. Schorn, and William J. Wilson 271
Application of Singular Perturbation Methods to Resonance Problems by Yun-Yuan Shi and Martin C. Eckstein 275
Erratum: New Orbit for Pluto and Analysis of Differential Corrections (*Astron. J.* **72**, 973, 1967) by Charles J. Cohen, Elbert C. Hubbard, and Claus Oesterwinter 290

Plates

Plate I (Graham and Doremus) 291
Plates II-V (Riihimaa) 292

NUMBER 1360

Articles

Observations of Variable Radio Sources at 2.8 cm by W. J. Medd, J. L. Locke, B. H. Andrew, and Sidney van den Bergh 293
Measurements of the Flux Density of Discrete Radio Sources at Centimeter Wavelengths. I. Observations at 2695 MHz (11.3 cm) by K. I. Kellermann, I. I. K. Pauliny-Toth, and W. C. Tyler 298
Radio Emission from the Nebula Sharpless 261 and the Surrounding Galactic Region by John R. Dickel 310
Five-Color Intermediate-Band Photometry of Stars, Clusters, and Galaxies by Robert D. McClure, and Sidney van den Bergh 313
B-Emission Stars and Galactic Rotation by David Crampton 338
HD 23631: A Short Period Binary and Early Am Star by Peter S. Conti 348
Studies of Visual Double Stars. I. by David D. Meisel 350
Parallax, Proper Motion, and Orbital Motion of the Visual Binary Σ2398 by Peter van de Kamp, Nahide Gün Gökkaya, and Wulff Dieter Heintz 361
Double Stars (List V) in the Astrographic Zones +32°, +33°, and +34° by A. N. Goyal and R. S. Khandelwal 366
Comets and Nongravitational Forces by B. G. Marsden 367
Erratum: Transformation of Hill's Equation—A Method of Solution by G. E. O. Giacaglia 379

Plates

Plate I (Dickel) 380

NUMBER 1360

Supplement

Special Meeting on Solar Astronomy of the American Astronomical Society, Held 1–3 February 1968 in Tucson, Arizona by the Kitt Peak National Observatory and the University of Arizona S53
Abstracts of Papers Presented at the 126th Meeting of the American Astronomical Society, Held 1–4 April 1968 at the University of Virginia, Charlottesville, Virginia S86

Observatory Reports

Dudley S128
Florida State University Radio S129
Kitt Peak National and Cerro Tololo Inter-American S130

Notices

Facilities for Visitors at Kitt Peak National Observatory and Cerro Tololo Inter-American Observatory by N. U. Mayall S157
Guest Investigators at the Mount Wilson and Palomar Observatories by H. W. Babcock S159
New Books Received S160

NUMBER 1361

Articles

A High-Sensitivity 1415 MHz Survey at North Declinations between 19° and 37° by R. S. Dixon and J. D. Kraus 381
Application of a Random Event Quasar Model to the Optical Variability of 3C273 by Tom Manwell and M. Simon 407
The Beam Shape of the NRAO 300-ft Telescope and its Influence on 21-cm Line Measurements by Carl Heiles and Wilson Hoffman 412
A New Interferometric Test and its Application to the 84-in. Reflecting Telescope at Kitt Peak National Observatory by James B. Saunders and Robert J. Bruening 415
Results of an Infrared Stellar Survey by Stephen D. Price 431
Photographic Brightness Profiles of Coma Cluster Galaxies. II. Calibration and Reduction Procedure by Herbert J. Rood and William A. Baum 442

The Structure of Star Clusters. V. Star Counts in 54 Globular Clusters by Ivan R. King, Edmund Hedemann, Jr., Steven M. Hodge, and Raymond E. White ... 456
A Catalogue of Fundamental Data for Classical Cepheids in the Galaxy by J. D. Fernie and Joan O. Hube ... 492
Dwarf Cepheid HD 199757 by Kam-Ching Leung ... 500
Spectroscopic Binary 57 Pegasi by William Hackos, Jr., and Benjamin F. Peery, Jr. ... 504
Dynamics of the Triple System Zeta Aquarii by Robert S. Harrington ... 508
Orbits of Ten Visual Binaries by W. D. Heintz ... 512
Some Performance Data for Eastman Kodak IIa Emulsions by David W. Latham ... 515
Hypersensitization of Infrared-Sensitive Photographic Emulsions by David Morrison and Edward H. Greenberg ... 518
Perturbation Theory for Strongly Perturbed Dynamical Systems. I. by William H. Jefferys ... 522

Plates

Plates I-XI (Dixon and Kraus) ... Following page 396
Plates XII-XVI (Saunders and Bruening) ... 528
Plate XVII (Hackos and Peery) ... 532

NUMBER 1362

Articles

Variations in the Primeval Helium Abundance by E. R. Harrison ... 533
Motions and Structure of the Filamentary Envelope of the Crab Nebula by Virginia Trimble ... 535
Use of BV_r Photometry to Derive Metal Abundances in G8-K2 Giants by Edward J. Mannery, George Wallerstein, and Gary A. Welch ... 548
Some Interesting Massive Spectroscopic Binary Systems by Alan H. Batten ... 551
Four-Color Photoelectric Photometry of Two High-Latitude Clusters by I. Epstein ... 556
A Stellar Group in Line of Sight with the Large Magellanic Cloud by N. Sanduleak and A. G. Davis Philip ... 566
UBV Photometry of Star Clusters in the Magellanic Clouds by Sidney van den Bergh and Gretchen L. Hagen ... 569
Search for Variables in the Globular Cluster NGC 7492 by Sue Ann Barnes ... 579
Distance of the Cepheid SU Cassiopeae by René Racine ... 588
Space Distribution of Stars in the Southern Milky Way. I. A Region in Norma by John S. Drilling ... 590
Statistical Mechanics of a Collisionless Self-Gravitating System by Frank Hohl and Janet W. Campbell ... 611
Families of Figure-Eight Orbits in the Restricted Three-Body Problem by G. Bozis ... 616
Mass of the Earth–Moon System from Observations of Eros, 1893–1966 by Jay H. Lieske ... 628
Galactic Radio Emission at 610.5 MHz. II. The Region between Galactic Longitudes 55° and 64° by H. Wendker ... 644
Astrometric Accuracy and the Flatness of Glass Filters by W. F. van Altena and R. C. Monnier ... 649

Errata and Addendum

Erratum and Addendum: Uniformly Valid Asymptotic Solution of Nonplanar Earth-to-Moon Trajectories in the Restricted Four-Body Problem (*Astron. J.* 72, 685, 1967) by Y. Y. Shi and M. C. Eckstein ... 653
Erratum: Radio Emission from the Nebula Sharpless 261 and the Surrounding Galactic Region (*Astron. J.* 73, 310, 1968) by John R. Dickel ... 655

Plates

Plate EI (Dickel) ... 656
Plates I and II (Trimble) ... 657
Plate III (Sanduleak and Philip) ... 659
Plate IV (van den Bergh and Hagen) ... 661
Plates V–X (Drilling) ... 663

NUMBER 1363

Articles

Some Current Problems in the Theory of Late-Type Stars by Pierre Demarque ... 669
Wavelength Dependence of Polarization. XII. Red Variables by A. Kruszewski, T. Gehrels, and K. Serkowski ... 677
Photometric Polarimetry of Late-Type Stars by H. Melvin Dyck ... 688
Short-Period Variable CY Aquarii by R. Zissell ... 696
Photoelectric Light Elements for the Eclipsing Variable TT Herculis by Arlo U. Landolt ... 705
The Peculiar Binary RT Lacertae by E. E. Milone ... 708
Distribution of Giant M Stars in the Galactic Disk by Bambang Hidajat and V. M. Blanco ... 712
Observations of Radio Sources at 10.03 MHz by A. H. Bridle and C. R. Purton ... 717
Influence of a Comet Belt beyond Neptune on the Motions of Periodic Comets by S. E. Hamid, B. G. Marsden, and F. L. Whipple ... 727
Revised Orbit of Comet Schwassmann-Wachmann I by Paul Herget ... 729
Hecuba Gap and the Hilda Group by André Deprit ... 730
Stability Characteristics of the Short-Period Trojan Librations by Eugene Rabe ... 732
Outer Satellites of Jupiter by Paul Herget ... 737
Determination of Ephemeris Time and Radius of the Lunar Umbra during the Total Solar Eclipse of 12 November 1966 by Gualberto M. Iannini ... 743
Parallaxes and Proper Motions of Stars from Plates Taken with the Van Vleck 20-in. Refractor by R. Grossenbacher, W. S. Mesrobian, and A. R. Upgren ... 744
Photographic Position Observations of Icarus by S. Vasilevskis, A. R. Klemola, and E. A. Harlan ... 747
NOTICE ... The Editors 748

NUMBER 1364

Articles

Observations of Intense Radio Sources with a 1°.5 Fan Beam by T. H. Legg, M. B. Bell, and R. C. Bignell 749
A Computer-Controlled Photometric Telescope by John F. McNall, Terrel L. Miedaner, and Arthur D. Code 756
Two Photographic Developers for Astronomical Use by John A. Difley 762
A List of Photometric Stellar Radii by David F. Gray 769
UBV Photometry of the Associations Anon b4 and NGC 2081 in the LMC by G. A. H. Walker and S. C. Morris 772
A Photometric Study of BV 357 by David Morrison and Nancy D. Morrison 777
Summary of 133 Parallaxes Determined with the 24-in. Refractor of the Sproul Observatory by Peter van de Kamp and Sarah Lee Lippincott 781
Orbits and Integrals in a Spiral Field by B. Barbanis 784
An Asymptotic Solution for a Class of Periodic Orbits of the Restricted Three-Body Problem by J. Kevorkian and J. E. Lancaster 791
Multicolor Photoelectric Photometry of the Brighter Planets. III. Observations from Boyden Observatory by William M. Irvine, Theodore Simon, Donald H. Menzel, C. Pikoos, and Andrew T. Young 807
Radar Time-of-Flight Measurements to Venus by R. M. Goldstein 829
Orbit of Neptune and the Mass of Pluto by R. L. Duncombe, W. J. Klepczynski, and P. K. Seidelmann 830

Proceedings of the Conference on Seyfert Galaxies and Related Objects, Held at Stewart Observatory, University of Arizona, 14–16 February 1968, A. G. Pacholczyk and R. Weymann, Editors 836

1. Introductory Remarks by R. Minkowski 842
2. A Comparison of the Optical Forms of Certain Seyfert Galaxies with the N-Type Radio Galaxies by W. W. Morgan 845
3. Some Optical Properties of Seyfert Galaxies and Related Objects by P. W. Hodge 846
4. Optical Observations of Two Seyfert Galaxies by Halton Arp 847
5. Continuum Energy Distributions of Seyfert Galaxies and Related Objects by J. B. Oke 849
6. Optical Variability of NGC 4151 by A. G. Pacholczyk and R. J. Weymann 850
7. Wavelength Dependence of Polarization in NGC 1068 by A. Kruszewski 852
8. Nonthermal Component in the Continuum of NGC 1068 by N. Visvanathan and J. B. Oke 853
9. Spectroscopic and Photometric Observations of the Nuclei of Seyfert Galaxies by M. F. Walker 854
10. Emission-Line Intensities in Seyfert Galaxies and Quasistellar Objects by E. J. Wampler 855
11. Spectral Variations in the Nucleus of NGC 4151 by H. Smith, D. Weedman, and W. W. Morgan 857
12. Photographic, Photometric, and Spectroscopic Observations of Seyfert Galaxies by G. de Vaucouleurs and A. de Vaucouleurs 858
13. Narrow-Band Filter Photographs of the Nucleus of NGC 1068 by F. Bertola 861
14. Velocities and Line Strengths in the Seyfert Galaxy NGC 3227 by Vera C. Rubin and W. Kent Ford, Jr. 861
15. Spectral Variations of the Nucleus of NGC 3516 by Y. Andrillat 862
16. Multicolor Photometry of Seyfert Galaxies and Measurement at 1.55 μ of the Jet in M87 by W. Z. Wisniewski and D. E. Kleinmann 866
17. Infrared Observations of Seyfert Galaxies, Quasistellar Sources, and Planetary Nebulae by F. J. Low and D. E. Kleinmann 868
18. Infrared Radiation from the Nuclei of Seyfert Galaxies by A. G. Pacholczyk and R. J. Weymann 870
19. Millimeter Observations of Seyfert Galaxies and Quasistellar Sources by E. E. Epstein and W. G. Fogarty 873
20. Radio Observations of NGC 1068 by H. Spinard 874
21. Radio-Frequency Structure and Time Variations in the Seyfert Galaxies 3C84 and 3C120 by K. I. Kellermann and I. Pauliny-Toth 874
22. Radio Structure of Seyfert Galaxies and other Spirals by C. M. Wade 876
23. Optical Structure of Peculiar Galaxies in a Central Field of the Coma Cluster by Herbert J. Rood 879
24. Photometric Anomalies in the Nuclei of Galaxies by W. G. Tifft 879
25. Emission Line Haro Galaxies by David L. DuPuy 882
26. Photometry of Southern Quasistellar Objects, N Galaxies, and Possibly Related Objects by Bengt E. Westerlund and Jasper V. Wall 883
27. Photographic Photometry of the Seyfert Galaxy 3C120 by T. D. Kinman 885
28. Spectroscopic Study of Peculiar Elliptical Galaxies by A. N. Stockton 887
29. Remarks on the Spectra of N-Type Galaxies by C. R. Lynds 888
30. Similarities between Seyfert Galaxies, N-Type Galaxies, and Quasistellar Objects by E. M. Burbidge 890
31. Two New Seyfert Galaxies from Markarian's List of Galaxies with Strong uv Continua by E. Ye Khachikian 891
32. Statistics of Galaxies with Peculiar Nuclei by J. L. Sérsic 892
33. New Observations of Compact Galaxies by W. L. W. Sargent 893
34. Physical Conditions in the Nucleus of NGC 4151 by J. B. Oke and W. L. W. Sargent 895
35. Calculated Line Intensities for Models of Seyfert Galaxy Nuclei by R. E. Williams and R. J. Weymann 895
36. An Interpretation of the Variations of the Spectrum of NGC 3516 by S. Souffrin 897
37. On the Nuclear Structure of Seyfert Galaxies and the Broadening of the Emission Lines by Electron Scattering by Noboru Kaneko and Hiroshi Ohtani 899
38. X-Ray Emission in the Nuclei of Seyfert Galaxies by W. H. Tucker and C. B. Tarter 901
39. Calculated Balmer Decrements for Radiative Excitation by Power-Law Spectra by D. E. Osterbrock 904
40. Relationship between the Supernova Theory of Quasistellar Objects and Seyfert Galaxies by Stirling A. Colgate 905
41. Theoretical Aspects of the Relationship between Seyfert Galaxies, N-Type Galaxies, and Quasistellar Objects by G. R. Burbidge and F. Hoyle 907
42. On the Acceleration of Particles in the Nuclei of Seyfert Galaxies by E. Schatzman 909
43. A Mechanism for Quasar Continuum Radiation and its Possible Application to Seyfert Nuclei by P. A. Sturrock and P. A. Feldman 910
44. Connection between Seyfert Galaxies, N-Type Radio Galaxies, and Quasistellar Sources by J. M. Barnothy and M. F. Barnothy 912
45. Concluding Remarks by L. Woltjer 914
46. Concluding Remarks: Spectroscopic Problems by D. E. Osterbrock 916

Plates

Plates S-I–S-V (Minkowski) 919
Plate S-VI (Walker) 923
Plate S-VII (Bertola) 925
Plate S-VIII (Kinman) 927
Plates S-IX–S-XII (Stockton) 929
Plate S-XIII (Lynds) 933
Plates S-XIV–S-XVII (Burbidge) 935
Plates S-XVIII–S-XXI (Khachikian) 939
Plate S-XXII (Williams and Weymann) 943

NUMBER 1365

Articles

Neutral Atomic Hydrogen in 32 Galaxies of Small Angular Diameter by Morton S. Roberts 945
Radio Observations of Two H II Regions by J. L. Caswell 949
Measurements of the Flux Density and Spectra of Discrete Radio Sources at Centimeter Wavelengths. II. The Observations at 5 GHz (6 cm) by I. I. K. Pauliny-Toth and K. I. Kellermann 953
Observations of the Phase Effect of Venus at 8.6-mm Wavelength by P. M. Kalaghan, K. N. Wulfsberg, and L. E. Teleford 970
A Statistical Ray Analysis of The Scattering of Radio Waves by the Solar Corona by Joseph V. Hollweg 972
The Distribution of Interstellar Reddening Material by M. Pim FitzGerald 983
Classical Cepheids and Galactic Structure by J. D. Fernie 995
Photoelectric Photometry of A-Type Stars near the North Galactic Pole by A. G. Davis Philip 1000
UBV Observations of Field Galaxies by Robert D. McClure and Sidney van den Bergh 1008
The Cluster of Galaxies Abell 2199 by Eugene E. Clark 1011
The Frequency of Supernovae in Clusters of Galaxies by Roberto Barbon 1016
Absolute Magnitudes of Supernovae by Charles T. Kowal 1021
The Eclipsing Binary System AU Puppis by Charles R. Chambliss 1024
Motion of a Satellite of a Very Oblate Planet by J. M. A. Danby 1031
Change in Total Energy of Comets Passing Through the Solar System by Edgar Everhart 1039

Index

Author Index to Volume 73 1053
Subject Index to Volume 73 1061

NUMBER 1365

Supplement

ABSTRACTS of Papers Presented at the 127th Meeting of the American Astronomical Society, Held 21–23 August 1968 at the Dominion Astrophysical Observatory, Victoria, British Columbia S161
ADDENDUM: Abstract of Paper Presented at the 126th Meeting of the American Astronomical Society S211
NOTICE Sites for Optical Telescopes by N. U. Mayall S212
NOTICE by The Editors S212
INDEX of Authors for Abstracts Presented at AAS Meetings S213
INDEX of Notices S237
INDEX of Observatory Reports S237